

XXXIV. *Notes on the Structure and Affinities of Batideæ, Callitrichaceæ, Vochysiaceæ, and Cassythææ.* By B. CLARKE, Esq., F.L.S.

Read June 16th, 1859.

1. *On the Structure and Affinities of Batideæ and Callitrichaceæ.*

THE principal points in the structure of the genus *Batis*, P. Br., have become well known, but its affinities have not been decided, while those which have been suggested for it are proved to be, for the most part, if not entirely, impracticable; further analysis therefore seems required before its affinities can be brought to light; and the following additional particulars, as regards its structure, and especially the relative position of the ovules to the axis of the ovary, will, I believe, make it evident that it must be a near ally of the *Verbenaceæ*.

The male flowers are arranged in 4-rowed spikes, giving them a habit like that of the *Verbenaceæ* with 4-rowed spikes of flowers; but in one species the inflorescence becomes compound, which gives it in some degree the habit of a *Globularia*, as of *G. orientalis*. The calyx is reduced to one sepal, posterior; but, since in the *Acanthaceæ* also the calyx is sometimes very nearly obsolete, this negative character is of little value. The corolla is attached by a very slender basis to the calyx, and consists of four petals with long claws and oval or almost circular laminae, and of four stamens alternate with them, two of which are placed anterior and posterior, and two right and left of the axis*,—the two lateral stamens having the rudiment of an ovary slightly adhering to them, which is sometimes bifid, the segments being lateral.

The female flowers are in shorter spikes, which are 4-rowed, as in the male. The floral envelopes are deficient; but each ovary has at its base a quickly deciduous bractea (TAB. LXVIII. fig. 27), so that in the early stage the spike is completely enveloped in scales, and is also terminated with three or four pairs of minute flowerless scales. The stigmas are two, right and left of the axis, and the cells of the ovary four, so placed that two of them stand right, and two left of the axis, so as to correspond in their position with the two stigmas, each pair having no bundle of vessels between them, but being separated by very distinct bundles from the opposite pair (fig. 27 a). Each cell contains an erect anatropal ovule, the raphe and foramen of which are very distinct. The raphe is lateral in relation to the inner angle of each cell; but in each pair of cells the raphes are always turned towards each other (fig. 27 a), as in the *Verbenaceæ* and *Labiatae*, proving beyond doubt that the structure of the ovary is the same, consisting of only two carpels.

According to this view of its structure, *Batis* differs from the *Verbenaceæ* only in being diclinous and polypetalous, unless it is in the position of the stamens; for in the female

* This, at least, is their position in *B. maritima*, but whether it is always so may be a question.

flower no positive difference is apparent except in the carpels being right and left of the axis, instead of anterior and posterior: and in its deficiency of floral envelopes, it may, as far as relates to the corolla, be compared to the *Stilbaceæ*, near allies of *Verbenaceæ*, the female flowers of which are apetalous.

The position of the *Batideæ*, therefore, appears undoubtedly to be with the monopetalous families; and however contrary to the rules of affinity it would have appeared only a few years since, this makes it in some degree probable that *Callitrichaceæ* should also be stationed there, and near *Batideæ*, as the ovary has precisely the same structure, being 4-celled, and consisting of two carpels, right and left of the axis. In *Callitriche*, however, the ovules are suspended, amphitropal, with the raphe next the placenta, in which it corresponds with *Boragineæ*, or very nearly so*; the seed is albuminous, and the cotyledons are very short, as in *Stilbaceæ*, with which it further agrees in its anther, which closely resembles that of *Campylostachys* in shape, and in the peculiarity of the two cells being confluent at the apex, so that at the time of dehiscence it appears as if it had but one cell.

Callitriche may be compared with *Elatineæ*, especially if the structure of the ovary of *Tetradiclis* can be considered as analogous to that of *Callitriche*; but *Batis* does not appear to have any affinity with the polypetalous families, except that the long claws of its petals are like those which occur in *Caryophyllaceæ*. *Callitriche* differs from *Euphorbiaceæ* in its amphitropal ovules; besides which, hermaphrodite flowers are not uncommon.

2. Note on the Structure and Affinities of Vochysiaceæ.

One of the most remarkable characters in this family is that the carpel when single is posterior, as in *Erisma*; the single cell of the ovary is on the opposite side of the flower to the stamen, which is anterior, and in direct relation with the spur of the calyx, which belongs to the posterior sepal (fig. 28). This character I believe completely separates the *Vochysiaceæ* from the epigynous families, and especially from the *Onagraceæ*, with which they have been compared, as in that family the carpel when single is anterior; nor is it known to be always posterior in any of the epigynous families.

If the position of the single carpel is in the present instance taken as a guide to affinity, this family should be associated with one in which the flower is in some degree irregular, with the single carpel posterior; and these characters occur in *Daphnaceæ*, of which the *Vochysiaceæ* may be a polypetalous form †, standing in the same relation to the *Chryso-balanææ* and *Leguminosææ*, and especially to the former, as *Daphnaceæ* to *Proteaceææ*.

The relation, however, between *Vochysiaceææ* and *Daphnaceææ* is rather one of analogy than affinity, although perhaps there is no character to separate them except the absence

* In *Boragineææ* the ovule is scarcely suspended, being attached near or at the base of the cell, at the inner angle; but the raphe of the amphitropal ovule is on its under surface—which is, doubtless, equivalent to the ovule being suspended with the raphe next the placenta.

† In *Pimeleaæ* and other genera of *Daphnaceææ* there is a decided tendency to irregularity of the flower of the same kind as in *Grevilleaæ* among *Proteaceææ*, with the exception that the carpel is always posterior instead of anterior, and it is not uncommon for flowers of *Pimeleaæ* to have but one stamen anterior, as in *Erismaæ* (vide Ann. Nat. Hist. 2nd ser. vol. xi.).

of petals in *Daphnaceæ*; and it is doubtless among the polypetalous families that the more immediate relations of *Vochysiaceæ* are to be sought for,—the vicinity of *Rosaceæ*, *Leguminosæ*, and their allies (which are regarded as polypetalous forms of *Daphnaceæ* and *Proteaceæ*) appearing to be the true station of this family.

The relation of the *Vochysiaceæ* to *Chrysobalanææ* confirms this view of their affinities, as they may be regarded as differing from *Chrysobalanææ* only in the carpel when single being posterior instead of anterior; for it is on the posterior side of the flower that the stamens are deficient in both families, and the calyx in *Vochysiaceæ* is sometimes so nearly regular that the spur is scarcely apparent.

To the *Amygdalææ* they are doubtless equally allied, agreeing with them in the ovules when suspended having the raphe next the placenta*; but as the flowers in this family are always regular, the approach between them is less obvious.

To the *Rosaceæ* they may be compared in the remarkably convolute æstivation of the corolla; to *Pomaceæ* in the occasionally inferior ovary, the ovules when erect having the raphe next the placenta, and in the cotyledons being either flat or convolute; and to *Calycanthaceæ* in the imbrication of the calyx, which occasions the flower-buds to look like leaf-buds; and in their large anthers.

3. Note on Cassytheæ.

The affinity of this family having been for some time well known to be with the *Lauraceæ*, I have only to add that it agrees with them in the ovary consisting of a single carpel †, as is shown by a furrow on one side of the style, which is also of a paler colour (fig. 29), and by the ovule being attached to the same side of the ovary, so as to be in relation with the furrow in the style, the ovule being pendulous, not from the apex of the cell, but from one side near the apex, as in *Lauraceæ* (*vide* Ann. Nat. Hist. ser. 2. vol. xi.).

The carpel is also variable in its position in nearly the same degree as in the *Lauraceæ*, being occasionally posterior, and otherwise variable from anterior to lateral; and it agrees also with them in the ovule having the raphe dorsal (fig. 29), so that there does not appear to be any distinction between them except in parasitism.

* In those genera where the ovules are numerous, they are suspended, amphitropal, with the raphe next the placenta, and therefore the foramen is uppermost.

† The ovary of *Sassafras officinale* consists of a single carpel (*vide* Ann. Nat. Hist. 2ud ser. vol. xi.), but occasionally, although very rarely, it becomes dicarpous, with an imperfectly bifid style and parietal placentæ, consisting of two ribs on the opposite sides of the ovary, which are alternate with the styles. The ovaries of *Laurus*, *Cinnamomum*, and *Tetranthera* have also decidedly the appearance of consisting of but one carpel; but *Sassafras* being occasionally dicarpous, makes it probable that Nees v. Esenbeck is right in describing *Lauraceæ* as tricarpous, as when the ovules are two, and attached separately, the ovary would most likely be compound.

EXPLANATION OF THE PLATE.

TAB. LXVIII.

- Fig. 27. A portion of a spike of female flowers of *Batis maritima*, showing the scars left by the bracteæ :
a. a transverse section of the front ovary, showing the relation of the cells to its two stigmas, and bundles of vessels interposed between them, anteriorly and posteriorly, so that they form pairs right and left of the axis. The ovules are also seen to be in pairs right and left of the axis, indicated by the position of their raphes.
- Fig. 28. A longitudinal section of the ovary of *Erisma violacea*, showing the relative position of the spurred sepal and stamen, and that the ovules are attached on the anterior side of the ovary.
- Fig. 29. A longitudinal section of the ovary of *Cassytha filiformis*, showing the attachment of the ovule, and that the raphe is dorsal ; also a furrow in the style on the same side as the attachment of the ovule.